Verification

I, Christoph Kilian, hereby declare that the enclosed English translation is a true translation of the application PCT/EP2004/014109.

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Method for emptying and filling bulk goods containers avoiding contamination

The steadily growing demand for industrially manufactured products is also imposing increasing demands in terms of raw materials and components that are used. The products involving an increasing degree of specialisation, which means: increasingly higher degrees of purity, increasingly more effective substances and unfortunately also increasingly more dangerous substances, toxicity, the triggering of allergies, and the effects of contamination and pollution are also on the increase. The problems are going in two directions. Firstly in the area of operator protection - the operator must not be exposed to any danger - and secondly in the area of product protection - the product must not be contaminated with foreign substances. These are general requirements which are imposed mainly in bio- and food technology, chemical and pharmaceutical sectors of industry.

To meet these requirements the products to be processed are not handled openly but in closed transport containers, e.g. fixed transport containers, flexible transport containers (also called big-bags) or barrels. All transport containers may additionally be equipped with an inner film bag.

This raises the question as to how these transport containers can be emptied and filled avoiding contamination.

Whilst expensive docking systems are already available for fixed transport containers, e.g. split valves, cone systems or the like, there is absolutely no satisfactory solution for transport containers with a flexible outlet and inlet.

The problem lies in the fact that up till now it has not been possible to connect transport containers with a

flexible outlet in a form that is sealed from the surrounding area to a product inlet or product outlet of an installation or system, and to remove the emptied or filled barrel after emptying and filling again without contamination.

Conventional systems use mechanical clamping devices for connecting the barrels, where the outlet on the connection system is clamped and sealed. However, when the barrel is changed, both the connection system and the barrel are open. Contamination at the connection point and contamination of the operator and the surrounding area may result from dust-laden air and dripping residual product.

The object of the invention is to provide a method for empting and filling bulk goods containers with little contamination using protective films.

This object is achieved according to the invention with a method according to Claim 1, 7, 8 and 15. Advantageous embodiments of the invention constitute the object of the dependent claims.

Preferred embodiments of the method according to the invention are described in the following with reference to the attached drawings, where

Figs. 1 to 9 show method steps between an initial position and the next time this initial position is reached using a film carrier which is able to receive a film supply for several container changes, when a container with a flexible outlet is emptied,

Figs. 10 to 17 show method steps for disposal of the end of a protective film that can no longer be used and the fitting of a new one when empting a container,

Figs. 18 to 27 show steps for individual bag emptying with protective film for only one emptying process,

Fig. 28 shows the method during emptying a container with rigid outlet,

Figs. 29 to 39 show method steps of a filling process between an initial position and the next time this initial position is reached, using a foil carrier which is able to receive a film supply for several container changes,

Figs. 40 to 47 show method steps for disposing of the end of a protective film that can no longer be used, and the fitting of a new one,

Figs. 48 to 53 show method steps for cleaning the bottom of the filling/sealing mechanism.

Emptying process

As shown in Figs. 1 to 9, a connection tube 1, through which a flexible transport container fitted over connection tube 1, with the outlet at the bottom, is enclosed by a hose film 3 and is sealed by tying the hose film at 3.1, at the beginning of the emptying process. The hose film extends from a film carrier 2 surrounding the connection tube 1, in which carrier the film is present in a length sufficient for several emptying processes ("endless film"). The film is guided between an axial sealing ring 5, located in a sealing ring recess 6 on the upper edge of the connection tube, and the upper edge of connection tube 1 against which it acts, and can be removed from film carrier 2 in the required length. Hose film 3 is first tied at 3.1 above filling tube 1. Here the hose film is pulled out of the film carrier to the extent that an end piece that can be widened into a funnel shape is produced above the tying point. This end piece is inserted in a radial expanding

ring 9, which rests in a expanding ring recess 8, and is therefore clamped to the outlet edge of a flexible container (a so-called big bag, for example) arranged above filling tube 1, by means of a counter ring 10 designed as a disposable part, whose outside diameter is roughly equal to the inside diameter of radial expanding ring 9, at which time the container to be emptied, as shown at 11.1, is still tied up (See Figs. 1 to 3).

The hose film is then tied at 3.1, which gives rise to the condition shown in Fig. 4. The container to be emptied is then opened at 11.1 and the bulk goods contained in the container drop from the container through connection tube 1 (Fig. 5).

A pocket 3.8 of the hose film is here place inside connection tube 1 and protects the upper region of connection tube 1 from the adhesion of product. If the product pressure is high protective film 3 can be retained by a support tube 7 (shown in Fig. 5 as a dotted line). As soon as the flexible container (big bag) is emptied, and evacuated if necessary, the free end of hose film 3 is pulled together over expanding ring recess 8 and connected to the outlet of the container 11 at 3.2. In particular, it is tied to it as shown (Fig. 6).

Axial sealing ring 5 is then relieved of load and hose film 3 is pulled out until sufficient clean hose film is obtained that it can be sealed in the clean region at 3.4, and immediately above it at 3.3 (see Fig. 6). In particular it is tied, as shown.

Radial expansion ring 9 is then relieved of load and the hose film separated between the tying points 3.3 and 3.4 (see Fig. 7). Flexible container 11 can now be disposed of free of contamination. Counter ring 10 is a disposable part which is also disposed of.

Hose film is then pulled out of film carrier 2 again, until sufficient film is present below tying point 3.4 for a new connection funnel and it can be tied again immediately above the filling tube at 3.1 (Fig. 8). With the removal of the upper tying at 3.4 the hose film can be expanded to form a funnel with which the condition shown in Fig. 1 is again reached and the device is ready for a new filling process.

This means that after the emptied container is detached from connection tube 4, both the contaminated outlet of the container and the contaminated connection tube are never open but are always sealed by surrounding protective film.

Figs. 10 to 17 show method steps from a time when the remaining film contained in film carrier 2 is no longer sufficient for a further emptying process. The remaining film must be removed and at the same time it must be ensured that neither the remaining film can fall into connection tube 1 nor the connection tube, possibly contaminated, is unsealed at the top.

Fig. 10 shows the condition according to Fig. 7, except that the hose film supply is at the end.

As shown in Fig. 11, axial sealing ring 5, which clamps the hose film against the filling tube edge, is relieved of load and both recess 6 for axial sealing ring 5 and recess 8 for the expansion ring are removed so that film carrier 2 is accessible and can be removed (Fig. 11), a new film carrier 2, with a new film, is fitted (Fig. 12) and the end of the hose film of the new film carrier 2 is secured to a suitable elastic fixing ring 4 on connection tube 1. The beginning of the new hose film is then pulled over the old remaining film and both films are tied at 3.5 underneath tying point 3.4 (Fig. 13). Both films are then pulled up

one inside the other together with the elastic fixing ring of the old film, and the new hose film tied twice underneath the old hose film lying in it at 3.6 and 3.7 (Fig. 14). The new hose film is then cut between the two tying points 3.6 and 3.7 so that the remaining old hose film, packed in a piece of new hose film, can be disposed of (Fig. 15). The ting point at 3.7 prevents the packet cut off with the old hose film from falling into connection tube 1, and at the same time ensures that the connection tube is sealed.

Figs. 16 and 17 correspond to Figs. 8 and 9 and the associated method steps correspond to those described with reference to Figs. 8 and 9.

During the emptying of an individual bag it is not necessary to provide hose film for several emptying processes. Connection tube 1 is then surrounded with hose film for a single emptying process, the design of the parts being otherwise the same.

The method steps for this case, including disposal of the hose film used by means of a new hose film, are shown in Figs. 18 to 27. In this case Figs. 18 to 21 correspond to Figs. 2 to 5, Figs. 22 and 23 correspond to Figs. 6 and 7, Figs. 24 and 25 correspond to Figs. 12 and 13, and Figs. 26 and 27 correspond to Figs. 14 to 17, the only difference being that the packet containing the old film is not cut off until the end of the process.

The advantage of this embodiment is that the connection funnel is not contacted by product and is therefore completely free of contamination, thus the connection to the outlet of the container to be emptied takes place without contamination. This is because a new single film, screened by the old hose film, does not come into contact with the edge of the connection tube, which can be

contaminated under certain circumstances. The new hose film is protected in the same way as the beginning of an endless film, which replaces a used endless film.

Fig. 28 shows the method when applied to a container with a rigid outlet, the container being designed as a fixed transport container 14 with sealing cap 13 in the container.

Radial expansion ring 9, with expanding ring recess 8 and counter ring 10, are dispensed with. The connection funnel of hose film 3, described above, is secured directly to the container outlet by means of a clamp band 12. After the tie is loosened at tying point 3.1, the container can be emptied.

After emptying, hose film is tied twice in the clean region, after being pulled out, as described with reference to Fig. 6, and cut in between (Fig. 7). This ensures that the container can be cut off without contamination.

As far as the replacement of film carrier 2 is concerned, this is carried out exactly as described above for containers with a flexible outlet.

Apart from sealing point 3.1, the other sealing points 3.2 - 3.7 can also be advantageously formed, for example, by welding or another permanent type of sealing.

Filling process

As shown in Figs. 29 and 39, at the beginning of the filling process a connection tube 1, through which a flexible transport container placed underneath it is to be filled, is wrapped in a hose film 3 and sealed by tying of the hose film at 8.1. To protect from falling product and to minimise product loss, a further sealing mechanism 20

can be integrated in connection tube 1. Hose film 3 extends from a film carrier 2 surrounding the connection tube, in which carrier it is present in a length sufficient for several filling processes ("endless film"). Film 3 is guided between a radial sealing ring 19 located at the lower edge of the connection tube and connection tube 1, and can be taken from film carrier 2 in the required length by pulling. Hose film is first tied at 8.1 underneath connection tube 1. Here the hose film is pulled out of the film carrier until a piece of hose that can be widened is produced underneath the tie. Counter ring 10 is inserted in this end piece. Inlet 11.2 of the flexible transport container 11 can then be clamped and sealed with protective film 3 and counter ring 10 in the container inlet radial sealing ring 9 (see Figs. 29 to 31).

The connection between connection tube 1 and transport container inlet 11.2 is opened by opening the tie of the hose film at 8.1. The transport container can be filled after sealing mechanism 20 is opened (Fig. 33). Here a pocket of the hose film is placed on the edge of the container inlet and protects it from coarse product adhesion.

As soon as the flexible container (big bag) 11 is completely filled and sealing mechanism 20 is closed, radial sealing ring 9 on connection tube 1 is relieved of load and fresh hose film 3 is pulled out until sufficient clean hose film is obtained for it to be sealed in the clean region at 8.2 and immediately underneath at 8.3 (see Fig. 34). In particular it can be tied at those points, as shown.

After hose film 3 is cut off between seals 8.2 and 8.3, a product sample can be removed by hand, if necessary, from transport container 11 and enclosed in the hose film by ting at 8.4. Inlet 11.2 of transport container 11 must then

be tied initially above radial sealing ring 9 with tie 8.5, then below radial sealing ring 8.6, and once again, immediately below this, at 8.7. Radial sealing ring 9 is then relieved of load and the hose film is cut off between tying points 8.4 and 8.5 (cutting off the sample bag) and between 8.6 and 8.7 (see Fig. 37). The film pocket, with counter ring 10 enclosed, can now be disposed off without contamination.

Hose film is then pulled out of film carrier 2 once again until sufficient film is present above tying point 8.2 for a new connection funnel, and this can be tied once again immediately underneath connection tube 1 at 8.1 (Fig. 38). When the lower tie at 8.2 is removed, hose film 3 can again be widened to form a funnel, with which the condition shown in Fig. 29 is again reached and the device is ready for a new filling process.

This means that after the filed container 11 is detached from connection tube 1 both the contaminated inlet of the container and the contaminated connection tube are never open but are always sealed by surrounding protective film.

Figs. 40 to 47 show method steps from a time when the remaining film contained in film carrier 1 is no longer sufficient for a further filling process. The remaining film must be disposed of and at the same time it must be ensured that the filling tube is at no time unsealed.

Fig. 40 shows the condition shown in Fig. 37, except that the hose film supply is used up.

As shown in Fig. 41, radial sealing ring 19 and container inlet radial sealing ring 9 are removed so that film carrier 2 is accessible and can be removed. A new film carrier 2 with new film 3 is fitted (Fig. 42) and the end of the hose film is secured with a suitable elastic fixing

ring 4 to connection tube 1. The beginning of the new hose film is then pulled over the old remaining film and sealed at 8.8 (Fig. 43). The old film with its fixing ring is then pulled off and enclosed in a film pocket by tying the new film 8.9 and the hose film is tied once again at a short distance above 8.9 at 8.10 (Fig. 44). After hose film 3 is cut between tying points 8.9 and 8.10, the remaining old film can be disposed of with the new protective film surrounding it. Radial sealing 19 and container inlet radial sealing ring 9 can now be returned to the working position.

Figs. 46 and 47 correspond to Figs. 38 and 39 and the associated method steps for forming a new connection funnel correspond to those described with reference to Figs. 38 and 39.

Figs. 48 to 51 show method steps that are required if it is necessary to clean the bottom of sealing mechanism 20 due to product adhesions.

Fig. 48 shows the condition shown in Fig. 39 after completion of a filling process. A cleaning cloth is packed in a film bag in a suitable clean surrounding area, with or without cleaning agent. This bag can now be enclosed in the connection funnel of hose film 3, with tie 8.12. After tie 8.1 is loosened and the cleaning bag is opened, the surface of sealing mechanism 20 can be wiped. Protective film 3 is then tied again at 8.2 and 8.13 briefly underneath connection tube. The hose film is cut off between the tying points and the film pocket is disposed off with the cleaning utensils (Figs. 50 and 51).

Figs. 52 and 53 correspond to Figs. 38 and 39, and the associated method steps for forming a new connection funnel correspond to those described with reference to Figs. 38 and 39.

Apart from sealing point 8.1, the other sealing points 8.2 - 8.13 can advantageously also be formed by welding, for example, or another permanent method of sealing.

Reference symbols:

1 Connection tube
- 1.1 Bead for protective film (endless film end)
- 1.2 Bead for protective film (film change)

2 Film carrier

3 Hose film
- 3.1 - 3.7 Tying and sealing points
- 3.8 Film pocket
- 8.1 -8.12 Tying and sealing points

4 Elastic fixing ring

5 Axial sealing ring (static or dynamic)

6 Sealing ring recess

7 Support tube

8 Expansion ring recess

9 Radial expansion ring (radial sealing ring)

10 Counter ring (disposable)

11 Flexible transport container (e.g. big bag)
- 11.1 Sealing point on the transport container
- 11.2 Transport container inlet

12 Clamp band

13 Sealing cap (drip protection)

14 Fixed transport container (container)

31 Dosing mechanism, conveying mechanism, installation

33 Flexible balance disconnection

44 Aeration and de-aeration

54 Cleaning cloth for sealing mechanism

55 Fixing for film carrier